The Effects of Season on Visual and Photographic Assessment of Subtidal Geoduck Clam *(Panope generosa* Gould*)* Populations

BY

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(1 Plate)

INTRODUCTION

The Washington State Department of Fisheries routinely conducts surveys of clam stocks in Puget Sound for management purposes by divers equipped with SCUBA. Geoduck populations [*Panope generosa* (Gould, 1850)] are estimated by visual counts of "shows" (either siphons or marks in the substrate made by siphons) along measured transect lines (Goodwin, 1973).

Earlier surveys demonstrated that the portion of the geoduck population detected by divers varied widely from 26% to 87% (Goodwin, 1973). Variability in "showing" has been reported in other clam species (Flowers, 1973). Geoducks live permanently buried in the substrate, the average burrow being 52 cm deep in Hood Canal, Washington (Andersen, 1971). When the siphons are extended up to or above the substrate surface and the clams are actively pumping water, they are readily visible to divers. At other times the siphons may be withdrawn below the surface and the siphon holes filled with sand, mud and detritus, leaving no indication of the clam buried below. Frequently marks in the substrate are observed and the presence of geoducks can be verified by divers probing the depression with their fingers. The siphons are large, up to 8 cm across and have a characteristic texture.

The objective of the present study was to more precisely define how the percentage of the geoduck population detected by divers changes seasonally in 2 small subtidal plots. The information developed in this study is used to correct diver survey data to provide more accurate population estimates.

The study area was a delta formed at the mouth of Big Beef Creek in Hood Canal, Washington. The delta has a gentle slope with sand and mud substrate. The study plots were established in a high density geoduck bed at the minus 9.1 m level (calculated from zero tide).

MATERIAL and METHODS

Geoduck abundance within the 2 plots (each 45.7 m × 1.8 m) was assessed by divers placing small wire stakes next to each siphon observed. This process was repeated on each visit until no unstaked siphons were present. Considerable effort was expended to insure that all geoducks detectable were staked. The total number staked represented the actual geoduck population within the plots. All wire stakes were then removed and the plots allowed to return to normal.

Monthly counts of geoduck siphons were then made from January to December 1974 using our standard transect method and the percentage of the total estimated population observed during each monthly visit calculated. These observations were carried out by 3 divers who alternated between the plots to reduce the chance of bias from an individual diver remembering the location of certain geoducks within the plots.

In addition, 4 small 0.46 m × 0.46 m plots were photographed monthly to further document the seasonal change in "shows." The plots were carefully approached and photographed manually using a Nikonos 35 mm camera with ectachrome film. Tripod-mounted cameras proved unsatisfactory because the slightest disturbance of the bottom caused the clams to retract their siphons. McErlean & Howard (1971) found that mechanical disturbance of the bottom affected "shows" of Eastern soft-shell clams (*Mya arenaria*).

RESULTS and DISCUSSION

The percentage of the geoduck populations detected in the 2 plots varied from a low of 5% in January to a high of 59.8% in May, and averaged 38.0% in Plot A and 36.8%

Table 1

Number of geoducks and percentage of estimated populations observed in monthly visual counts in two plots near Big Beef Creek, Washington

Date	Plot A (estimated geoduck population = 316)		Plot B (estimated geoduck population = 358)	
1974	Number observed	% observed	Number observed	% observed
Jan.	33	10.4	18	5.0
Feb.	101	32.0	117	32.7
March	142	44.9	169	47.2
April	133	42.1	170	47.5
May	172	54.4	214	59.8
June	168	53.2	178	49.7
July	105	33.2	106	29.6
Aug.	146	46.2	150	41.9
Sept.	144	45.6	174	48.6
Oct.	160	50.6	134	37.4
Nov.	195	30.1	114	31.8
Dec.	41	13.0	37	10.3
Mean		38.0		36.8

in Plot B over the entire year (Table 1). Student's T test was conducted on various combinations of the data using the arc sine transformation as suggested by Sokal & Rohlf, 1969. Winter data (November-February) from Plot A were compared with winter data from Plot B and no significant differences were found ($t = 0.25$; d. f $= 3$). Plot A summer data (March-October) were also tested against summer data from Plot B and no significant differences were found ($t = 0.27$; d. f $= 7$). When data from Plots A and B were pooled and winter data tested against those from the summer, the differences were highly significant ($t = 6.01$; t. f $= 11$) demonstrating that the siphons were more readily detected by divers in the summer than in the winter.

Data from the photographic plots also demonstrated that geoducks were more easily observed in the summer months than in the winter (Table 2). The seasonal changes are shown in Figures *1a - 1d*. None of the 5 geoducks present in the 0.45 m × 0.45 m plot can be seen in the February (winter condition) photograph. The May photograph (summer condition) clearly shows 5 clams with their siphons extended. Four can be seen in the July photograph; 3 of these are not distinct. In the November photograph, only 1 siphon mark can be seen.

Several small-scale surveys have been conducted in Puget Sound with underwater television and geoducks were found in water as deep as 60 m. Geoducks living at these depths apparently behave in a similar manner as

Explanation of Figures *1* to *4*

Plot 1: Geoduck Population = 5

Figure *1*: February 1974; no geoducks showing
Figure *2*: May 1974; all 5 geoducks showing, siphons open (pumping water)
Figure *3*: July 1974; 4 of 5 siphons showing, algae covered geoduck in lower left hand corner
Figure *4*: November 1974; 1 out of 5 geoducks showing as a slight mark, siphons are withdrawn, algae cover almost gone

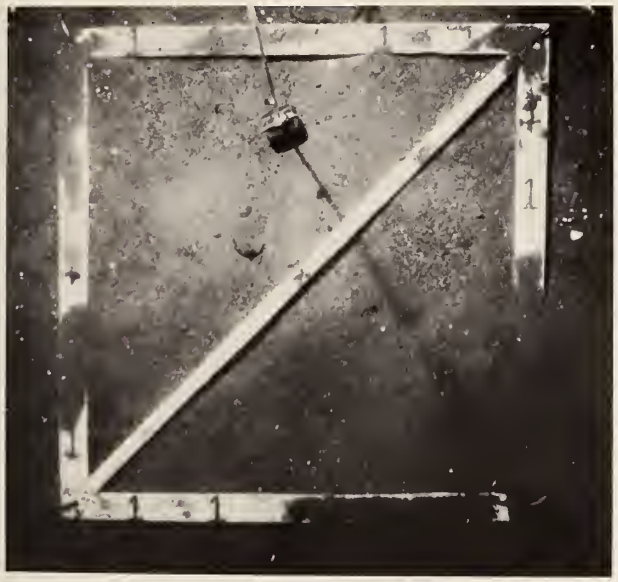

Figure 1

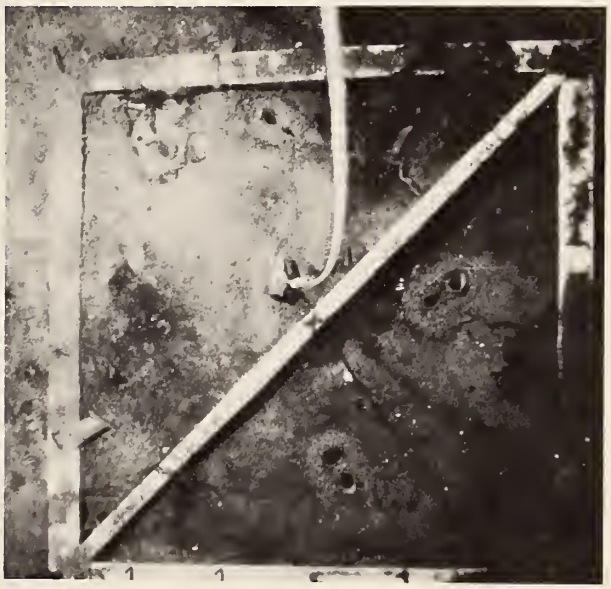

Figure 2

Figure 3

Figure 4